BUILDING METHOD OF OVERHEAD INFRASTRUCTURE

BACKGROUND OF THE INVENTION

[0001] The present invention concerns a method for building an overhead infrastructure with extended overhead lines such as various cables and, more particularly, a method for building an overhead infrastructure capable of minimizing loads to utility poles, increasing suspension spaces on the utility poles, decreasing costs for constructing the overhead infrastructure, and improving an appearance and maintenance workability thereof.

[0002] In general, when various cables such as communication cable or the like are to be erected, a messenger wire is put up as a tensile line between utility poles, and metal hangers such as cable hangers are attached one by one to this messenger wire with an interval of 50 to 60cm for hanging cables in parallel. A complex cable having a messenger wire combined with a cable may be used instead.

[0003] Erection of the cables has been independently operated by each of business conductors. For example, when two business conductors erect communication cables in the same section, those erection works may be separately done all the way. Therefore, whenever a business conductor erects a cable between utility poles, it is a common practice to extend a messenger wire.

[0004] In such a practice as described above, there have been problems raised as follows. First, since the weight of the messenger wire and attachment metal parts and the tension of the messenger wire become more than necessary, a load to utility poles is increased, thereby making

the utility poles easier to cause breakage or collapses. If supporting lines are added to the utility poles, the breakage and the collapses can be prevented. The supporting lines, however, are obliquely drawn from an upper part of the utility pole to the ground, so it is not always possible to have spaces for installing the supporting lines.

[0005] Moreover, since points for suspending cables, which are occupied by each of business conductors, are set on the utility pole with a predetermined interval in a vertical direction, there is a lack of suspension spaces on the utility poles. Besides, a number of cables and lead-in wires are flooded around the utility poles, thereby deteriorating an appearance and maintenance workability of the utility poles. Furthermore, each of the business conductors usually complete by itself erection works including operations for drawing a messenger wire, thereby causing a problem to increase costs for construction.

SUMMARY OF THE INVENTION

[0006] It is an object of the present invention to provide a method for building an overhead infrastructure capable of minimizing loads to utility poles, increasing suspension spaces on the utility poles, decreasing costs for constructing the overhead infrastructure, and improving an appearance and maintenance workability thereof.

[0007] The method for building the overhead infrastructure of the present invention to attain the aforementioned object comprises a step of drawing a tensile line between utility poles, a step of putting around the tensile line a plastically deformable coil having a metal wire formed in a spiral shape and synthetic resin coated on a surface of the metal wire, a

step of elongating the coil until its plastic deformation so as to form a basic construction with a series of overhead cableway capable of holding a plurality of overhead lines inside the spiral of the coil, and a step of extending an overhead line in an empty space of the overhead cableway on demand.

[0008] As described above, to the tensile line drawn between utility poles, the basic construction with the series of overhead cableway capable of holding a plurality of overhead lines is installed by using the plastically deformable coil, and then an overhead line is extended in an empty space of the overhead cableway on demand. Thus, there is no necessity to draw a tensile line such as a messenger wire between the utility poles when the overhead line is extended. Therefore, it is possible to avoid that the weight of the messenger wire and attachment metal parts and the tension of the messenger wire become more than necessary, thereby minimizing loads to utility poles. As a result, without supporting lines added to the utility poles, breakage and collapse of utility poles hardly happen, thereby improving safety.

[0009] Since the overhead cableway is capable of holding a plurality of the overhead lines, it is possible to increase suspension spaces on the utility poles. Moreover, the overhead lines may be arranged in the overhead cableway, thus an appearance and maintenance workability of the utility poles can be improved. Furthermore, the basic construction may be used by a plurality of business conductors, so the work by each of business conductors to extend a tensile line such as a messenger wire may be omitted, thereby decreasing costs for constructing the overhead

infrastructure.

[0010] In the present invention, it is preferable to form a common use system of an overhead infrastructure, by accommodating a plurality of overhead lines, respectively managed by each of a plurality of business conductors, in the overhead cableway. In the common use system, a plurality of overhead lines, respectively managed by each of a plurality of business conductors, are accommodated in the overhead cableway, and an administrator provides the business conductors with rights for using the overhead cableway for rent or for sale with a fee according to a number and weight of the overhead lines managed by each of the business conductors. That is, this invention aims to build the overhead infrastructure for its common use, and provides a common use method of the overhead infrastructure as a preferable embodiment.

[0011] As a result, a business conductor who does not have an infrastructure such as utility poles and tensile lines may be able to easily start a business utilizing overhead lines. For example, communication business conductors, without such a common use system, can not erect an overhead line such as a communication cable and the like unless an infrastructure including utility poles and tensile lines has been built. However, using the above described common use system, they can drastically reduce an initial investment cost since only the overhead line need to be prepared and erected.

[0012] The administrator who administrates the basic construction rents or sells the empty spaces in the overhead cableway to the business conductors for the purpose of extending the overhead lines, and, if

necessary, remove a useless overhead line from the overhead cableway to make an empty space again. Of course, a part of core lines contained in the overhead line can be rented or sold to the business conductors.

[0013] According to the present invention, there is a benefit that a plurality of overhead lines extended between utility poles can be totally managed. For the installation of the basic construction, tensile strength of the tensile line is preferably set based on the maximum load estimated from an amount of the overhead lines possibly inserted in the overhead cableway. Also, for the installation of the basic construction, a size of the overhead cableway is preferably set based on an estimated demand for the overhead lines. When these administrative methods are introduced, the overhead infrastructure can be built with the most preferred appearance.

[0014] When the overhead lines are required to diverge between the utility poles, it is preferable that distribution of the overhead lines is carried out through gaps of the coil. That is, the overhead cableway formed of the coil allows the distribution of the line through gaps of the coil, so it will contribute to further improving the appearance and the maintenance workability.

[0015] In the present invention, as a tensile line, a messenger wire made of a plurality of twisted steel wires, a complex cable integrating messenger wire and cable (so-called SS type cable) or others can be selected. On the other hand, the overhead line includes not only various cables such as a communication cable, a television cable, a power cable and the like, that contain a number of metallic wires or optical fibers in a bundle but also lead-in wires to offices or houses such as a power line, telephone line

and the like.

BRIEF DESCRIPTION OF DRAWINGS

[0016] Fig. 1 shows an example of plastically deformable coil used for the overhead infrastructure building method of the present invention; Fig. 1(a) is a side view of the coil, Fig. 1(b) a cross-section of a resin coated wire composing the coil, and Fig. 1(c) a side view of the resin coated wire.

[0017] Fig. 2 shows an example of the coil extension device used for the overhead infrastructure building method of the present invention; Fig. 2(a) is a side-view of non-elongated coil, and Fig. 2(b) a side-view of elongated coil.

[0018] Fig. 3 shows another coil extension device used for the overhead infrastructure building method of the present invention; Fig. 3(a) is a side-view of non-elongated coil, and Fig. 3(b) a side-view of elongated coil.

[0019] Fig. 4 shows a sate of cable erection by the overhead infrastructure building method of the present invention; Fig. 4(a) shows a side-view, and Fig. 4(b) a view along the line X-X.

[0020] Fig. 5 is a side view showing another sate of cable erection by the overhead infrastructure building method of the present invention.

[0021] Fig. 6 is an enlarged view of a portion Y in the Fig.5.

DETAILED DESCRIPTION OF PREFERRED EMBODIMENT

[0022] Now, the present invention will be described in detail referring to attached drawings.

[0023] Fig. 1 shows an example of plastically deformable coil used for the overhead infrastructure building method of the present invention. As shown in Fig. 1(a) to Fig. 1 (c), a plastically deformable coil 1 has a

structure wherein a resin coated wire 1A made by coating around a metal wire 1a with synthetic resin 1b is formed in a spiral shape. The cross-section shape of the resin coated wire 1A is preferably non-circular, including polygons such an octagon or others. When the resin coated wire 1A is twisted so as to rotate the non-circular shape spirally in the longitudinal direction of the metal wire 1a, the wind sound generated during the cable erection may be reduced. The coil 1 has a length L in the non-elongated state without load before used for the cable erection, however, it will have a state elongated to a length corresponding to one span between electric utility poles during the cable erection. When the elongated coil is short or too long for one span between electric utility poles, the coil 1 may be cut off or prolonged.

[0024] The coil 1 mentioned above is provided with such property that the metal wire 1a deforms plastically, when the coil is elongated from its non-elongated length L. To be more specific, when the coil is elongated by 10 times or more than its non-elongated length L, the coil 1 shrinks from the diameter D and, at the same time, it deforms plastically so that the length after elongation will be kept. If this metal wire 1a deforms at an elongation less than 10 times of its non-elongated length L, it becomes difficult to elongate the coil 1 so as to keep the spiral pitch at constant interval.

[0025] To provide the aforementioned coil 1 made of complex material of the metal wire 1a and the synthetic resin 1b with said property, the material of the metal wire 1a and the synthetic resin 1b may be selected properly and the cross-section ration of the metal wire 1a at the resin

coated wire 1A may be set properly.

[0026] As the metal wire 1a, iron wire, copper wire, aluminum wire or the like of 1.0 to 5.0 mm in diameter can be used. Especially, it is preferable to used iron wire to provide the most appropriate plastic deformation for cable erection. Besides, it is advantageous to use galvanized wire to prevent from corrosion. If the diameter of the metal wire 1a is less than 1.0 mm, its capability to hold the cable becomes insufficient and, on the contrary, if it is more than 5.0 mm, the coil itself becomes heavy unfavorably.

[0027] It is preferable to set the ratio of the cross-section of the metal wire to the cross-section of the resin coated wire is equal or superior to 25%. If the ratio of the cross-section of the metal wire is less than 25%, elastic deformation of the synthetic resin 1b makes plastic deformation of the metal wire 1a difficult. Note that the cross-section shape of the metal wire 1a is not specially limited and, in addition to the circle as shown in the drawing, it can take oval, triangular, square, octagonal or other polygonal shape.

[0028] On the other hand, as synthetic resin 1b, thermoplastic resin such as polyester, polyamide, polyolefin can be used. Among these thermoplastic resins, polyester is especially preferable. As this polyester, polyethylene terephthalate, polybutylene terephthalate, or copolymer polyester obtained by copolymerization of them with a third component such as adipic acid, isophthalic acid, isophthalic sulfonate and polyethylene glycol can be cited.

[0029] Moreover, as polyamide, nylon 6, nylon 66, nylon 610, nylon 612,

nylon 11, nylon 12 and copolymer polyamide made by combination of components of respective nylon can be cited. As polyolefin, polyethylene, polypropylene and the like can be cited.

[0030] Obviously, these thermoplastic resins may comprise as desired heat resistant agent, weather resistant agent, photoresistant agent, antioxidant, antistatic additive, smoother, dye or other normal additive components as necessary.

[0031] The non-elongated length L of the coil 1 is preferably short from the viewpoint of handling; however, its workability will be favored if it is set to elongate at least up to 1 span between utility poles during cable erection. For this effect, when the non-elongated length L is within the range of 500 to 2000 mm, the elongated length is preferably set a range of 10 to 80 times, especially 20 to 60 times of that length L. Moreover, the outer diameter D of the non-elongated coil 1 is advantageously set to a range of 20 to 120 mm.

[0032] Now, the overhead infrastructure building method of the present invention will be described. In the present invention, after a messenger wire is drawn as a tensile wire between utility poles, the aforementioned coil 1 is set around the messenger wire and elongated along the messenger wire. For the elongation of the coil 1, a coil extension device shown in Fig. 2 or Fig. 3 can be used to extend the aforementioned coil 1.

[0033] In Fig. 2, a coil extension device 10 has a structure made by assembling a bone member 11 in a cone shape, and is provided with a reducing aperture 12 smaller than the outer diameter of the coil 1 at the apex of the cone. Moreover, the coil extension device 10 is made of two

members divided along the cone slant, and these both members can open or close by means of a hinge 13 and, moreover, can be cramped in closed state by means of a bolt 14.

[0034] When the coil 1 is extended by the aforementioned coil extension device 10, as shown in Fig. 2(a), first the coil 1 is inserted outside around a messenger wire W drawn between utility poles P, P, then one end side of the coil 1 is attached to the messenger wire W with a cram member 2, then the coil extension device 10 provided with the reducing aperture 12 smaller than the outer diameter of the coil 1 is disposed at one end side of the coil 1. To be more specific, the reducing aperture 12 is positioned at the one end side of the coil 1 and the coil extension device 10 is installed so that the cone section of the bone member 11 covers the coil 1. Then, as shown in Fig. 2(b), the coil extension device 10 is pulled toward the other end side of the coil 1 along the messenger wire W, by means of a traction wire 15 attached to the cone bottom of the bone member 11, and the coil 1 is elongated until its plastic deformation all the way being discharged from the reducing aperture 12. In order to operate from the ground the coil extension device 10 moving along the messenger wire W, a hook 16 is hung on the messenger wire W, and a ground operation rope 17 is attached to this hook 16. It is also advantageous to attach the other end side of the coil 1 to the hook 16.

[0035] When the coil 1 is extended using the coil extension device 10 as mentioned above, the pitch and the outside diameter of the elongated coil 1 can be set based on the size of the reducing aperture 12 and, moreover, the coil 1 can be extended evenly along its total length. As the coil extension

device 10 is assembled of the bone member 11, the coil 1 can be handled easily through its gap, and moreover, as it is light, it will not apply much load to the messenger wire W. Note that, when the coil 1 is extended with help by the coil extension device 10, a cable may be extended inside the coil 1 at the same time.

[0036] On the other hand, in Fig. 3, a coil extension device 20 has a structure made by assembling a bone member 21 in a cone shape, and is provided with a reducing aperture 22 smaller than the outer diameter of the coil 1 at the apex of the cone. Moreover, the coil extension device 20 is made of two members divided along the cone slant, and these both members can open or close by means of a hinge 23 and, moreover, can be cramped in closed state by means of a bolt 24.

[0037] When the coil 1 is extended by the aforementioned coil extension device 20, as shown in Fig. 3(a), first the coil 1 is inserted outside around a messenger wire W drawn between utility poles P, P, then one end side of the coil 1 is attached to the messenger wire W with a cramp member 2, then the coil extension device 20 provided with the reducing aperture 22 smaller than the outer diameter of the coil 1 is disposed at the other end side of the coil 1. To be more specific, the reducing aperture 22 is positioned at the other end side of the coil 1 and the coil extension device 20 is installed so that the cone section of the bone member 21 covers the coil 1.

[0038] Then, as shown in Fig. 3(b), the other end side of the coil 1 is connected to a leading chariot 26 running freely over the messenger wire W, then the other end side of the coil 1 is drawn by the leading chariot 26 along the messenger wire W, with the position of the coil extension device

20 fixed with respect to the utility pole P using a fixing rope 25 attached to the cone bottom of the bone member 21, and the coil 1 is elongated until its plastic deformation all the way being discharged from the reducing aperture 22. This leading chariot 26 permits only the advance, and a brake acts during the regression. In order to operate from the ground the leading chariot 26 moving along the messenger wire W, a ground operation rope 27 is attached to the leading chariot 26. Note that such leading chariot 26 may also be applied to the method shown in Fig. 2.

[0039] When the coil 1 is extended using the coil extension device 20 as mentioned above, the pitch and the outside diameter of the elongated coil 1 can be set based on the size of the reducing aperture 22 and, moreover, the coil 1 can be extended evenly along the total length. As the coil extension device 20 is assembled of the bone member 21, the coil 1 can be handled easily through its gap, and moreover, as it is light, it will not apply much load to the messenger wire W. In addition, if the tip of the cable C is connected to the leading chariot 26, the cable C can be extended at the same time as the extension of the coil 1.

[0040] Fig. 4 shows a sate of cable erection by the overhead infrastructure building method of the present invention. As shown in Fig. 4(a) and Fig. 4(b), according to the overhead infrastructure building method of the present invention, a plastically deformable coil 1 is used, the coil 1 is inserted outside around the messenger wire W drawn between utility poles, and then the coil is elongated until its plastic deformation so as to form a basic construction with a series of overhead cableway S capable of holding a plurality of overhead lines such as the cable C inside the spiral of the coil.

When the basic construction is installed, a cable C required at the time may be extended simultaneously. At this time, a plurality of cables C may be extended together. Then, another cable C will be extended in an empty space of the overhead cableway S on demand.

[0041] For the installation of the basic construction, tensile strength of the messenger wire W is set based on the maximum load estimated from an amount of the cables C possibly inserted in the overhead cableway S. That is, since the number of cables C possibly inserted in the overhead cableway S is substantially determined by the section area of the overhead cableway S, the maximum load to the messenger wire with cables C inserted in the overhead cableway without any gaps can be estimated by taking the number of the cables C, the weight of the cables C, the distance between the utility poles and the like into account. Then, the tensile strength of the messenger wire W may be set so as to bear the estimated maximum load.

[0042] Moreover, for the installation of the basic construction, a size of the overhead cableway S is set based on an estimated demand for the cables C. That is, the demand for cables C that may be required in the future is estimated according to the civil planning in the region and the situation of the utility pole installation. Then, the size of the overhead cableway may be set so as to satisfy the estimated demand.

[0043] The estimates on the maximum load and the demand do not necessarily have to be accurate. If the maximum load is larger than the estimate, the number of the cables C extended in the overhead cableway may be lowered from the initially planned one. If the demand for the cables C is more than the estimate, the basic construction may be added.

[0044] According to the aforementioned method for building the overhead infrastructure, the basic construction with the series of overhead cableway S capable of holding a plurality of cables C is installed in advance, and then a cable C is extended in an empty space of the overhead cableway S on demand. Thus, there is no necessity to draw a messenger wire W between the utility poles when the cable C is extended. Therefore, it is possible to avoid that the weight of the messenger wire W and attachment metal parts and the tension of the messenger wire W become more than necessary, thereby minimizing loads to utility poles. As a result, without supporting lines added to the utility poles, breakage and collapse of utility poles hardly happen, thereby improving safety.

[0045] Since the overhead cableway S is capable of holding a plurality of the cables C, it is possible to increase suspension spaces on the utility poles. That is, in the conventional skill, one cable is supported by one messenger wire, and suspension points are set on the utility pole with a predetermined interval in the vertical direction. Therefore, there was a lack of suspension spaces. On the other hand, the aforementioned overhead cableway S holds a plurality of cables in bundle, so the number of required suspension points may be reduced under a condition where the number of cables is constant. Because of this, it is possible to have more suspension spaces on the utility poles and to erect more cables.

[0046] Moreover, a plurality of cables C may be arranged in the overhead cableway S, thus an appearance and maintenance workability of the utility poles can be improved. Furthermore, the basic construction may be used by a plurality of business conductors, so the work by each of

business conductors to extend a messenger wire W may be omitted. Therefore, costs for constructing the overhead infrastructure may be reduced.

[0047] Moreover, a plurality of cables C, respectively managed by each of a plurality of business conductors, are accommodated in the overhead cableway S to form the common use system of overhead infrastructure, thus the aforementioned various profits can be shared by business conductors. In this case, an administrator of the basic construction may provide the business conductors with rights for using the overhead cableway S for rent or for sale with a fee according to a number and weight of the cables C managed by each of the business conductors. Of course, the administrator of the basic construction may join the communication business utilizing the cable C.

[0048] In the overhead infrastructure building work using the aforementioned coil 1, the following merits may be obtained. First of all, all suspension points for hanging the cable C through a helical loop with a constant interval can be formed, and the cable C can be extended by only one operation of simply elongating the coil 1 between utility poles. Moreover, once the cable C is extended, the coil 1 can be used as cable fixing hanger as it is. Consequently, it makes unnecessary to erect temporarily the cable C by means of a cable extension jig such as pulley, and simplifies the operation to attach a number of metal hangers one by one at a constant interval as in the conventional cable erection.

[0049] Moreover, as the metal wire 1a deforms plastically when the coil 1 is elongated, the plastically deformed metal cable 1a prevents the cable C

from drooping, even if a coil fastener to the messenger wire W is off, or a part the coil 1 is cut off. Besides, the cable does not shrink to its original length even if the coil 1 fixed end comes off, or the elongated non-fixed end is released accidentally during the cable erection work. Therefore, the cable C can be held in a stable state during and after the erection. Moreover, even if a fire breaks out in the vicinity of the cable erection emplacement, causing the cable 1 inflamed and the synthetic resin 1b burned out, the cable C can be held by the metal wire 1a.

[0050] Fig. 5 shows another sate of cable erection by the overhead infrastructure building method of the present invention. In this embodiment, the basic construction with a series of overhead cableway S is formed along the messenger wire drawn between the utility poles P, P with the use of the coil 1, and after the communication cable C is extended, a lead-in wire C_1 is further added in the empty space of the overhead cableway S on demand.

[0051] In this case, the lead-in wire C_1 pulled out from a connecting terminal box B may be led along the messenger wire W in the overhead cableway S and distributed towards a house 30 through a gap of the coil 1 at a optional position. When the wire distributing operation is held, a distributing member 31 is attached to the messenger wire W, a supporting wire 33 is extended from the distributing member 31 through a lead-in member 32, and then the lead-in wire C_1 can be guided along the supporting wire 33, as shown in Fig.6.

[0052] According to the aforementioned wire distribution, appearance and maintenance workability of the utility pole P can be improved. That

is, in the conventional wire distribution, a lead-in wire pulled out from a connecting terminal box is once led to the utility pole so as to be fix thereto by a fastener and further needs to be led to a distributing member attached to the messenger wire using a supporting wire. Moreover, every lead-in wire is required with the similar distribution work. Therefore, the lead-in wires are flooded around the utility poles, causing the appearance and the maintenance workability drastically deteriorated. On the other hand, if the basic construction having the overhead cableway formed by the coil 1 is utilized, those lead-in wires attached around the utility pole in the conventional skill can be removed.

[0053] As described above, according to the present invention, a tensile line is drawn between utility poles, a plastically deformable coil comprising a metal wire formed in a spiral shape and synthetic resin coated on a surface of the metal wire is put around the tensile line, the coil is elongated until its plastic deformation so as to form a basic construction with a series of overhead cableway capable of holding a plurality of overhead lines inside the spiral of the coil, and an overhead line is extended in an empty space of the overhead cableway on demand. Therefore, it is possible to have advantages of minimizing loads to utility poles, increasing suspension spaces on the utility poles, decreasing costs for constructing the overhead infrastructure, and improving an appearance and maintenance workability thereof.